STATEMENT OF VERIFICATION

I, Yutaka YOSHIDA, of 816 Ikebukuro White House Bldg., 20-2, Higashi-Ikebukuro 1-chome, Toshima-ku, Tokyo, Japan, hereby declare that I am the translator of the documents attached, and certify that the following is a true English Translation to the best of my knowledge and belief.

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Yutaka Yoshida

[TITLE OF THE DOCUMENT] APPLICATION FOR PATENT

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[INVENTOR]

[Address or residence] c/o Kabushiki Kaisha Honda Gijyutsu Kenkyusho 4-1, Chuo 1-chome, Wako-shi, Saitama

[Name] Hiroshi MIZUGUCHI

[INVENTOR]

[Address or residence] c/o Kabushiki Kaisha Honda Gijyutsu Kenkyusho 4-1, Chuo 1-chome, Wako-shi, Saitama

[Name] Hideaki TAKADA

[INVENTOR]

[Address or residence] c/o Kabushiki Kaisha Honda Gijyutsu Kenkyusho 4-1, Chuo 1-chome, Wako-shi, Saitama

[Name] Yoshinori MASUBUCHI

[APPLICANT]

[Identification number] 000005326

[Name] HONDA MOTOR CO., LTD.

[ATTORNEY]

[Identification number] 100081972

[Address or residence] 816, Ikebukuro White House Bldg., 20-2, Higashi Ikebukuro 1-chome, Toshima-ku, Tokyo

[Patent Attorney]

[Name] Yutaka YOSHIDA

[Telephone No.] 03-5956-7220

[FEES]

[Deposit Account No.] 049836

[Amount] 21000 Yen

[PAPERS ATTACHED HERETO]

[Title] Specification	1
[Title] Drawing	1
[Title] Abstract	1
[General Power of Attorney No.]	0016256
[Necessity of Proof]	Necessary

[TITLE OF THE DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] SHIFTING SYSTEM FOR OUTBOARD MOTOR

[WHAT IS CLAIMED IS]

[CLAIM 1] A shifting system for an outboard motor having an internal combustion engine, and conducting shifting by rotating a shift rod to move a clutch from a neutral position so as to be engaged with one of a forward gear and a reverse gear such that an output of the engine is transmitted to a propeller to propel a boat to move forward or backward, comprising:

an electric motor rotating the shift rod;

a reduction gear reducing an output of the electric motor in speed and transmitting the output to the shift rod; and

a rotation angle sensor detecting a rotation angle of the shift rod,

wherein the electric motor, the reduction gear and the rotation angle sensor are integrally formed as a unit that is installed on a mount frame positioned above the shift rod.

[CLAIM 2] The system according to claim 1, further comprising:

a shift lever position sensor detecting a position of a shift lever installed at the boat from among positions of neutral, forward and reverse; and

shift control means feedback-controlling operation of the electric motor based on the detected rotation angle of the shift rod and the detected shift lever position such that the rotation angle of the shift rod becomes equal to a desired angle of rotation that allows the clutch to engage the forward gear or the reverse gear.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Industrial field in which the invention is to be utilized]

This invention relates to a shifting system (shift mechanism) for an outboard motor.

[0002]

In shifting systems for outboard motors, shifting is usually conducted by moving a shift rod having a cam at its distal end in the longitudinal direction (upward and downward direction) to slide a shift slider such that a clutch is switched from its neutral position to

either a position where it engages with a forward gear or a position where it engages with a reverse gear.

[0003]

Alternatively, a shift rod is provided with a rod pin at a position eccentric from the rod center, displacement of the rod pin caused by a rotation of the shift rod (i.e., the distance of displacement corresponds to a circular arc whose radius is the amount of eccentricity of the rod pin) makes a shift slider slide to effect shifting.

[0004]

In the shifting systems including that mentioned above, when the shift rod is operated manually, since the operator tends to have an unpleasant operation "feel" owing to, for instance, heavy load, it has hitherto been proposed installing an actuator at the outside of the outboard motor, specifically at the hull, and connecting it with the shift rod in the outboard motor through a cable and a link mechanism to power-assist the driving of the shift rod, i.e., the shifting (refer to Patent Literature 1 for example).

[0005]

[Patent Literature 1]

Japanese Laid-Open Patent Application No. Hei 4 (1992) – 95598 (FIG. 1 etc.)

[0006]

[Problems to be solved by the invention]

However, since the foregoing prior art is configured such that the actuator is installed at the hull and connected with the shift rod in the outboard motor through the cable and link mechanism, it causes disadvantages that its structure is complicated, that it adds to the number and weight of the components, and it needs a space for the actuator at the hull.

[0007]

An object of the present invention is therefore to overcome the foregoing issues by providing a shifting system for an outboard motor such that an actuator is utilized as a power supply to drive a shift rod for improving operation feel, the connecting structure between the shift rod and actuator is simply configured to prevent increase in number of

components and weight, while avoiding a problem regarding space utilization of the hull.

[0008]

[Means of solution to the problems]

In order to achieve the object, as recited in claim 1, it is configured to have a shifting system for an outboard motor having an internal combustion engine, and conducting shifting by rotating a shift rod to move a clutch from a neutral position so as to be engaged with one of a forward gear and a reverse gear such that an output of the engine is transmitted to a propeller to propel a boat to move forward or backward, comprising: an electric motor rotating the shift rod; a reduction gear reducing an output of the electric motor in speed and transmitting the output to the shift rod; and a rotation angle sensor detecting a rotation angle of the shift rod, wherein the electric motor, the reduction gear and the rotation angle sensor are integrally formed as a unit that is installed on a mount frame positioned above the shift rod.

[0009]

It is thus configured such that the electric motor rotates the shift rod, the electric motor, the reduction gear reducing the output of the electric motor in speed and transmits it to the shift rod, the rotation angle sensor detecting the rotation angle of the shift rod are integrally formed as the unit, and the unit is installed on the mount frame positioned above the shift rod. With this, it becomes possible to mitigate the operation load more than that under manual operation of the shift rod, thereby improving operation feel. Further, since the connecting structure between the shift rod and actuator can be made simple, it can prevent increase in number of components and weight, thereby enabling to avoid a problem regarding space utilization of the hull.

[0010]

As recited in claim 2, it is configured to have the system further comprising: a shift lever position sensor detecting a position of a shift lever installed at the boat from among positions of neutral, forward and reverse; and shift control means feedback-controlling operation of the electric motor based on the detected rotation angle of the shift rod and the detected shift lever position such that the rotation angle of the shift

rod becomes equal to a desired angle of rotation that allows the clutch to engage the forward gear or the reverse gear.

[0011]

Since it is thus configured to detect the rotation angle of the shift rod and the position of the shift lever, feedback-control operation of the electric motor based on the detected values such that the rotation angle of the shift rod becomes equal to a desired angle of rotation that allows the clutch to engage the forward gear or the reverse gear, it becomes possible to ensure the shifting.

[0012]

[Embodiments]

A shifting system for an outboard motor according to an embodiment of the present invention will now be explained with reference to the attached drawings.

[0013]

FIG. 1 is an overall schematic view of the shifting system for an outboard motor, and FIG. 2 is an explanatory side view of a part of FIG. 1.

[0014]

Reference numeral 10 in FIGs. 1 and 2 designates an outboard motor built integrally of an internal combustion engine, propeller shaft, propeller and other components. As illustrated in FIG. 2, the outboard motor 10 is mounted on the stern of a boat (hull) 16 via a swivel case 12 that rotatably accommodates or houses a swivel shaft and shift rod (both described later) and via a stern bracket 14 to which the swivel case 12 is connected, to be freely steered about the vertical and horizontal axes.

[0015]

The outboard motor 10 is equipped with the internal combustion engine (hereinafter called "engine") 18 at its upper portion. The engine 18 is a spark-ignition, in-line four-cylinder gasoline engine with a displacement of 2,200 cc. The engine 18, located inside the outboard motor 10, is enclosed by an engine cover 20 and positioned above the water surface. An electronic control unit (ECU) 22 constituted of a microcomputer is installed near the engine 18 enclosed by the engine cover 20.

[0016]

The outboard motor 10 is equipped at its lower part with a propeller 24 and a rudder 26 adjacent thereto. The propeller 24 is powered by the engine 18 through a crankshaft, drive shaft, gear mechanism and shift mechanism (none of which is shown) to operate to propel the boat 16 in the forward and reverse directions.

[0017]

As shown in FIG. 1, a steering wheel 28 is installed near the operator's seat of the boat 16. A steering angle sensor 30 is installed near the steering wheel 28 and outputs a signal in response to the steered amount (manipulated variable) of the steering wheel 28 inputted by the operator. A throttle lever 32 is mounted on the right side of the operator's seat, and a throttle lever position sensor 34 is installed in the vicinity thereof and outputs a signal in response to the position of the throttle lever 32 manipulated by the operator.

[0018]

A shift lever 36 is installed near the throttle lever 32, and a shift lever position sensor 38 is installed in the vicinity thereof and outputs a signal in response to the position of the shift lever 36 manipulated (shifted) by the operator, specifically, a signal indicative of corresponding one of a neutral position, a forward position and a reverse position.

[0019]

A power tilt switch 40 for regulating the tilt angle and a power trim switch 42 for regulating the trim angle of the outboard motor 10 are also installed near the operator's seat. These switches output signals in response to tilt-up/down and trim-up/down instructions inputted by the operator. The outputs of the steering angle sensor 30, throttle lever position sensor 34, shift lever position sensor 38, power tilt switch 40 and power trim switch 42 are sent to the ECU 22 over signal lines 30L, 34L, 38L, 40L and 42L.

[0020]

A rotation angle sensor 44 (shown in FIG. 2) is installed at a position above the shift rod (explained later) and outputs a signal indicative of the rotation angle of the shift rod. The output of the rotation angle sensor 44 is sent to the ECU 22 over a signal line 44L.

[0021]

Further, near the swivel case 12 and the stern bracket 14 are installed an actuator, i.e., an electric motor 46, for steering (hereinafter called "steering motor") and a conventional power tilt-trim unit 48 for regulating the tilt angle and trim angle of the outboard motor 10 that are connected to the ECU 22 through signal lines 46L and 48L. Inside the engine case 20 is installed an actuator, i.e., an electric motor 50, for shifting (hereinafter called "shift motor") that rotates the shift rod and is connected to the ECU 22 through a signal line 50L.

[0022]

Based on the outputs of these sensors and switches, the ECU 22 operates the steering motor 46 to steer the outboard motor 10, and operates the power tilt-trim unit 48 to regulate the tilt angle and trim angle of the outboard motor 10. It also operates the shift motor 50 to conduct shifting, and another electric motor (not shown) for opening/closing the throttle valve to regulate the engine speed of the engine 18.

[0023]

FIG. 3 is an enlarged explanatory side view of FIG. 2. In FIG. 3, it is shown in a partially-cutaway manner.

[0024]

As illustrated in FIG. 3, the power tilt-trim unit 48 is integrally equipped with one hydraulic cylinder 48a for tilt angle regulation (hereinafter called "tilt hydraulic cylinder") and two hydraulic cylinders 48b for trim angle regulation (hereinafter called "trim hydraulic cylinder"; only one shown).

[0025]

The cylinder bottom of the tilt hydraulic cylinder 48a is fastened to the stern bracket 14 and through it to the boat 16 and the piston rod head thereof abuts on the swivel case 12. The cylinder bottom of each trim hydraulic cylinder 48b is similarly fastened to the stern bracket 14 and through it to the boat 16 and the piston rod head thereof abuts on the swivel case 12.

[0026]

The swivel case 12 is connected to the stern bracket 14 through a tilting shaft 52. In

other words, the swivel case 12 is connected to the boat 16 to be relatively displaceable to each other about the tilting shaft 52. The swivel shaft 54 is rotatably accommodated inside the swivel case 12. The swivel shaft 54 has its upper end fastened to a mount frame 56 and its lower end fastened to a lower mount center housing (not shown). The mount frame 56 and lower mount center housing are fastened to a frame on which the engine 18 and other components are mounted.

[0027]

The steering motor 46 and a gearbox 60 for reducing an output (rotational output) of the steering motor 46 are fastened to an upper portion of the swivel case 12. The gearbox 60 is connected, at its input side, to the output shaft of the steering motor 46 and is connected, at its output side, to the mount frame 56. Horizontal steering of the outboard motor 10 is thus power-assisted using the rotational output of the steering motor 46 to swivel the mount frame 56 and thus turns the propeller 24 and rudder 26. The overall rudder turning angle of the outboard motor 10 is 60 degrees, 30 degrees to the right and 30 degrees to the left.

[0028]

The output of the engine 18 (not illustrated in FIG. 3) is transmitted via the crankshaft (not shown) and a drive shaft 70 to a propeller shaft 74 accommodated in a gear case 72, and rotates the propeller 24 that is fixed to the propeller shaft 74. The rudder 26 is integrally formed with the gear case 72.

[0029]

FIG. 4 is an enlarged sectional view of the gear case 72. With reference to FIG. 4, the power transmission to the propeller shaft 74 will be explained in detail.

[0030]

As shown in the figure, a forward gear 76F and a reverse gear 76B are provided onto the outer periphery of the propeller shaft 74 to be rotatable in opposite directions by engagement with a drive gear 70a fixed to the bottom end of the drive shaft 70. A clutch 78 is disposed at a position between the forward gear 76F and the reverse gear 76B and rotates integrally with the propeller shaft 74.

[0031]

The gear case 72 rotatably accommodates the shift rod 80. The shift rod 80 is formed with, at its end surface, a rod pin 82 at a position eccentric from the center axis.

[0032]

The rod pin 82 is inserted into a cavity 84a of a shift slider 84 installed below the shift rod 80. The shift slider 84 is made slidable along a line extended from the propeller shaft 74 and the clutch 78, and is connected to the clutch 78 through a spring 86.

[0033]

FIGs. 5 to 7 show the rotation angles of the rod pin 80 etc. at each shift position of neutral, forward or reverse.

[0034]

As shown in FIGs 5 to 7, the rotation of the shift rod 80 makes the rod pin 82 displace along a locus of circular arc whose radius is corresponding to the amount of eccentricity from the center axis 80c of the shift rod 80. Specifically, the rotation of the shift rod 80 makes the rod pin 82 displaces in a direction in which the shift slider 84 slides (i.e., in the direction of a line SS extended from the axis of the shift slider 84). With this, the shift slider 84 slides through the cavity 84a such that the clutch 78 is brought into engagement with the forward gear 76F or the reverse gear 76R, or is held at the neutral position with no engagement.

[0035]

More specifically, as illustrated in FIG. 5, at the neutral position, a line connecting the shift rod's center axis 80c and the rod pin 82 intersects the line SS extended from the axis of the shift slider 84, with a right angle. The rotation angle of the shift rod 80 at this time is defined as zero. When the rotation angle of the shift rod is zero, the clutch 78 is meshed with neither the forward gear 76F nor the reverse gear 76B.

[0036]

As illustrated in FIG. 6, when the shift rod 80 is rotated clockwise viewed from the top by 90 degrees from the neutral position, in other words, when the shift rod 80 is rotated such that the rod pin 82 is positioned on the line SS, the rod pin 82 is displaced in the

direction of the line SS by an amount corresponding to the amount of eccentricity. As a result, the shift slider 84 slides, through the cavity 84a, toward the forward gear 76F in the direction of the line SS, and the clutch 78 is meshed with the forward gear 76F.

[0037]

Similarly to the shifting to forward, as shown in FIG. 7, when the shift rod 80 is rotated counterclockwise as viewed from the top by 90 degrees from the neutral position such that the rod pin 82 is positioned on the line SS, it makes the shift slider 84 slide toward the reverse gear 76B in the direction of the line SS, and the clutch 78 is meshed with the reverse gear 76B.

[0038]

Specifically, it is configured such that, when the position of the rod pin 82 at the neutral is defined as 0 degree, the angle of rotation of the clutch 78 for being engaged with each gear 76F, 76B is approximately plus/minus 90 degrees. In other words, the angle of rotation of the shift rod 80 is set to be a range of 180 degrees beginning from the line SS extended from the axis of the shift slider 84 and ending at the same line SS, such that the shift slider 84, the rod pin 82 and the center axis 80c of the shift rod 80 are aligned at the same straight line, at the beginning of shifting (when the clutch 78 is meshed with either the forward gear 76F or the reverse gear 76B). With this, the reaction force from the shift slider 84 to return to the neutral position does not act on the shift rod 80 as the torque to rotate it. Accordingly, it is no longer necessary to add a mechanism that retains the rotation angle of the shift rod 80 at the beginning of shifting, thereby achieving the simple structure.

[0039]

Returning to the explanation with reference to FIG. 3, the shift rod 80 penetrates the gear case 72 and the swivel case 12 (more precisely, the interior space of the swivel shaft 54 housed there), as shown in the figure, and finally reaches the inside of the engine cover 20 at its top end. The mount frame 56 is installed at a position above the top end of the shift rod 80 and equipped with a unit 90 that integrally comprises the shift motor 50, a reduction gear mechanism and a sensory device (explained later).

[0040]

FIG. 8 is a cross-sectional view taken along the line VIII-VIII of FIG. 3; FIG. 9 is an enlarged (partially skeleton) explanatory view showing the unit 90 illustrated in FIG. 8; and FIG. 10 is a cross-sectional view taken along X-X of Fig. 9.

[0041]

As shown in FIG. 3 and FIGs. 8 to 10, the unit 90 integrally comprises the shift motor 50, a reduction-gear mechanism 92 that reduces the output (rotational output) of the motor 50 and the rotation angle sensor 94 that detects the angle of rotation of the output shaft 92os of the reduction-gear mechanism 92. The unit 90 is detachably fastened, inside the engine cover 20, to the mount frame 56 by a plurality of bolts. The shift motor 50 is connected to the ECU 22 through a harness 96 (shown in FIGs. 8 and 10).

[0042]

As is best shown in FIGs. 9 and 10, the output shaft 50os of the shift motor 50 is fixed with a motor gear 50a that meshes with a first reduction gear 92a of a larger diameter (having more teeth) than the motor gear 50a.

[0043]

A second reduction gear 92b of a smaller diameter (having fewer teeth) than the first reduction gear 92a is fastened to the first reduction gear 92a coaxially therewith, and meshes with a third reduction gear 92c of a larger diameter. A fourth reduction gear 92d of a smaller diameter than the third reduction gear 92c is fastened to the third reduction gear 92c coaxially therewith.

[0044]

A fifth reduction gear 92e of a larger diameter than the fourth reduction gear 92d is fastened to the output shaft 92os of the reduction gear mechanism 92, and meshes with the fourth reduction gear 92d.

[0045]

As is shown in FIG. 10, an output shaft gear 92f is fastened to a portion near the lower end of the output shaft 92os of the reduction gear mechanism 92, and meshes with a shift-rod gear 80a fastened to a portion near the upper end of the shift rod 80. With this, the

output of the shift motor 50 is reduced in speed and is transmitted to the shift rod 80. Thus, the shifting of the outboard motor 10 is power-assisted by the rotational output of shift motor 50. This can mitigate the operation load more than that under manual operation of a shift rod, thereby improving operation feel.

[0046]

The aforesaid rotation angle sensor 94 is installed immediately above the output shaft 92os of the reduction-gear mechanism 92. The rotation angle sensor 94 is connected to the ECU 22 via a connector 94a and harness (not shown) and sends thereto the signal indicative of the angle of rotation of the output shaft 92os, i.e., the angle of rotation of the shift rod 80.

[0047]

The ECU 22 detects the position (including one among the neutral, forward and reverse) of the shift lever 36 manipulated (shifted) by the operator, and controls the operation of the shift motor 50 in response to the detected shift position to conduct the shifting. At the same time, the ECU 22 feedback-controls the operation of the shift motor 50 using the output of the rotation angle sensor 94 indicative of the angle of rotation of the shift rod 80.

[0048]

Specifically, when the shift lever 36 is detected to be at the neutral position, the ECU 22 sets a desired value (desired angle of rotation) of the shift rod 80 to the aforesaid 0 degree, and controls the operation of the shift motor 50 such that an error between the desired value and the detected value (current rotation angle of the shift rod 80) is to be zero. When the shift lever 36 is detected to be at the forward position, it sets the desired value to 90 degrees and controls the shift motor 50 operation such that the error between the desired value and the detected value is to be zero. When the shift lever 36 is detected to be at the reverse position, it sets the desired value to − 90 degrees and similarly controls the shift motor 50 operation such that the error between the desired value and the detected value is to be zero.

[0049]

Thus, the ECU 22 feedback-controls based on the outputs of the shift lever position sensor 38 and the rotation angle sensor 94, such that the rotation angle of the shift rod 80 becomes equal to the desired angle of rotation that allows the clutch 78 to engage the forward gear 76F or the reverse gear 76B, thereby enabling to conduct shifting surely.

[0050]

Having been described in the above, in the outboard motor shifting system according to this embodiment, since the shift rod 80 is rotated by the shift motor 50 to power-assist the shifting of the outboard motor 10, the operation load to the operator is mitigated more than that under manual operation, thereby improving operation feel.

[0051]

Further, since the shift motor 50 that rotates the shift rod 80, the reduction-gear mechanism 92 (first to fifth gears 92a, 92b, 92c, 92d, 92e, output shaft gear 92f, output shaft 92os) that reduces the output (rotational output) of the motor 50 in speed and the rotation angle sensor 94 that detects the rotation angle of the shift rod 80 are integrally formed as the unit 90 in such a manner that the unit 90 is installed on the mount frame 56 positioned above the shift rod 80, this can decrease the distance between the shift rod 80 and the actuator (shift motor 50) compared to the case that an actuator for driving a shift rod is installed at a boat, can make the structure simple and avoid increase in number of components and weight, thereby enabling to prevent a problem regarding space utilization of the boat 16.

[0052]

Further, since it is configured to detect the rotation angle of the shift rod 80 and the position (shifted position) of the shift lever 36 and based thereon, feedback-control such that the rotation angle of the shift rod 80 becomes equal to the desired angle of rotation that allows the clutch 78 to engage the forward gear 76F or the reverse gear 76B, this can ensure shifting without fail.

[0053]

As stated above, it is configured in the embodiment of this invention to have a shifting system for an outboard motor 10 having an internal combustion engine (engine 18),

and conducting shifting by rotating a shift rod 80 to move a clutch 78 from a neutral position so as to be engaged with one of a forward gear 76F and a reverse gear 76B such that an output of the engine is transmitted to a propeller 24 to propel a boat to move forward or backward, comprising: an electric motor (shift motor 50) rotating the shift rod 80; a reduction gear (reduction-gear mechanism 92 (first to fifth gears 92a, 92b, 92c, 92d, 92e, output shaft gear 92f, output shaft 92os)) reducing an output of the electric motor in speed and transmitting the output to the shift rod 80; and a rotation angle sensor 94 detecting a rotation angle of the shift rod 80, wherein the electric motor, the reduction gear and the rotation angle sensor 94 are integrally formed as a unit 90 that is installed on a mount frame 56 positioned above the shift rod 80.

[0054]

Further, it is configured to comprise a shift lever position sensor 38 detecting a position of a shift lever 36 installed at the boat 16 from among positions of neutral, forward and reverse; and shift control means (ECU 22) feedback-controlling operation of the electric motor based on the detected rotation angle of the shift rod 80 and the detected shift lever 36 position such that the rotation angle of the shift rod 80 becomes equal to a desired angle (90 or – 90 degrees) of rotation that allows the clutch 78 to engage the forward gear 76F or the reverse gear 76B.

[0055]

[Effects of the invention]

In claim 1, it is configured such that the electric motor rotates the shift rod, the electric motor, the reduction gear reducing the output of the electric motor in speed and transmits it to the shift rod, the rotation angle sensor detecting the rotation angle of the shift rod are integrally formed as the unit, and the unit is installed on the mount frame positioned above the shift rod. With this, it becomes possible to mitigate the operation load more than that under manual operation of the shift rod, thereby improving operation feel. Further, since the connecting structure between the shift rod and actuator can be made simple, it can prevent increase in number of components and weight, thereby enabling to avoid a problem regarding space utilization of the hull.

[0056]

In claim 2, since it is configured to detect the rotation angle of the shift rod and the position of the shift lever, feedback-control operation of the electric motor based on the detected values such that the rotation angle of the shift rod becomes equal to a desired angle of rotation that allows the clutch to engage the forward gear or the reverse gear, it becomes possible to ensure the shifting.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIGURE 1]

It is an overall schematic view of a shifting system for an outboard motor according to an embodiment of the invention.

[FIGURE 2]

It is an explanatory side view of a part of FIG. 1.

[FIGURE 3]

It is an enlarged explanatory side view of FIG. 2.

[FIGURE 4]

It is an enlarged sectional view of a gear case shown in FIG. 3.

[FIGURE 5]

It is an explanatory view showing a clutch, rod pin etc. shown in FIG. 4 when a shift position is neutral.

[FIGURE 6]

It is an explanatory view showing the clutch, rod pin etc. shown in FIG. 4 when a shift position is forward.

[FIGURE 7]

It is an explanatory view showing the clutch, rod pin etc. shown in FIG. 4 when a shift position is reverse.

[FIGURE 8]

It is a cross-sectional view taken along the line VIII-VIII of FIG. 3.

[FIGURE 9]

It is an enlarged (partially skeleton) explanatory view showing a unit illustrated in

FIG. 8.

[FIGURE 10]

It is a cross-sectional view taken along X-X of FIG. 9.

[DESCRIPTION OF THE NUMERALS]

10	Outboard motor
16	Boat (hull)
18	Engine (internal combustion engine)
22	ECU (shift control means)
24	Propeller
36	Shift lever
38	Shift lever position sensor
50	Shift motor (electric motor)
56	Mount frame
76F	Forward gear
76B	Reverse gear
78	Clutch
80	Shift rod
90	Unit
92	Reduction-gear mechanism (reduction gear)
92a	First reduction gear (reduction gear)
92b	Second reduction gear (reduction gear)
92c	Third reduction gear (reduction gear)
92d	Fourth reduction gear (reduction gear)
92e	Fifth reduction gear (reduction gear)
92f	Output shaft gear (reduction gear)
92os	Output shaft (reduction gear)
94	Rotation angle sensor

[TITLE OF THE DOCUMENT] ABSTRACT OF THE DISCLOSURE

[SUMMARY]

[PROBLEMS TO BE SOLVED] To provide a shifting system for an outboard motor that improves operation feel by utilizing an actuator as a power supply to drive a shift rod, and prevents increase in number of components and weight by configuring the connecting structure between the shift rod and actuator, thereby avoiding a problem regarding space utilization of the hull.

[MEANS OF SOLUTION] It is configured such that a shift rod 80 is rotated by a shift motor 50 to power-assist the shifting of an outboard motor 10, the shift motor 50, the reduction-gear mechanism 92 (first to fifth gears 92a, 92b, 92c, 92d, 92e, output shaft gear 92f, output shaft 92os) that reduces the output (rotational output) of the motor 50 in speed and a rotation angle sensor 94 that detects the rotation angle of the shift rod 80 are integrally formed as a unit 90, and the unit 90 is installed on the mount frame 56 positioned above the shift rod 80.

[SELECTED FIGURE] FIG. 10

FIG. 1

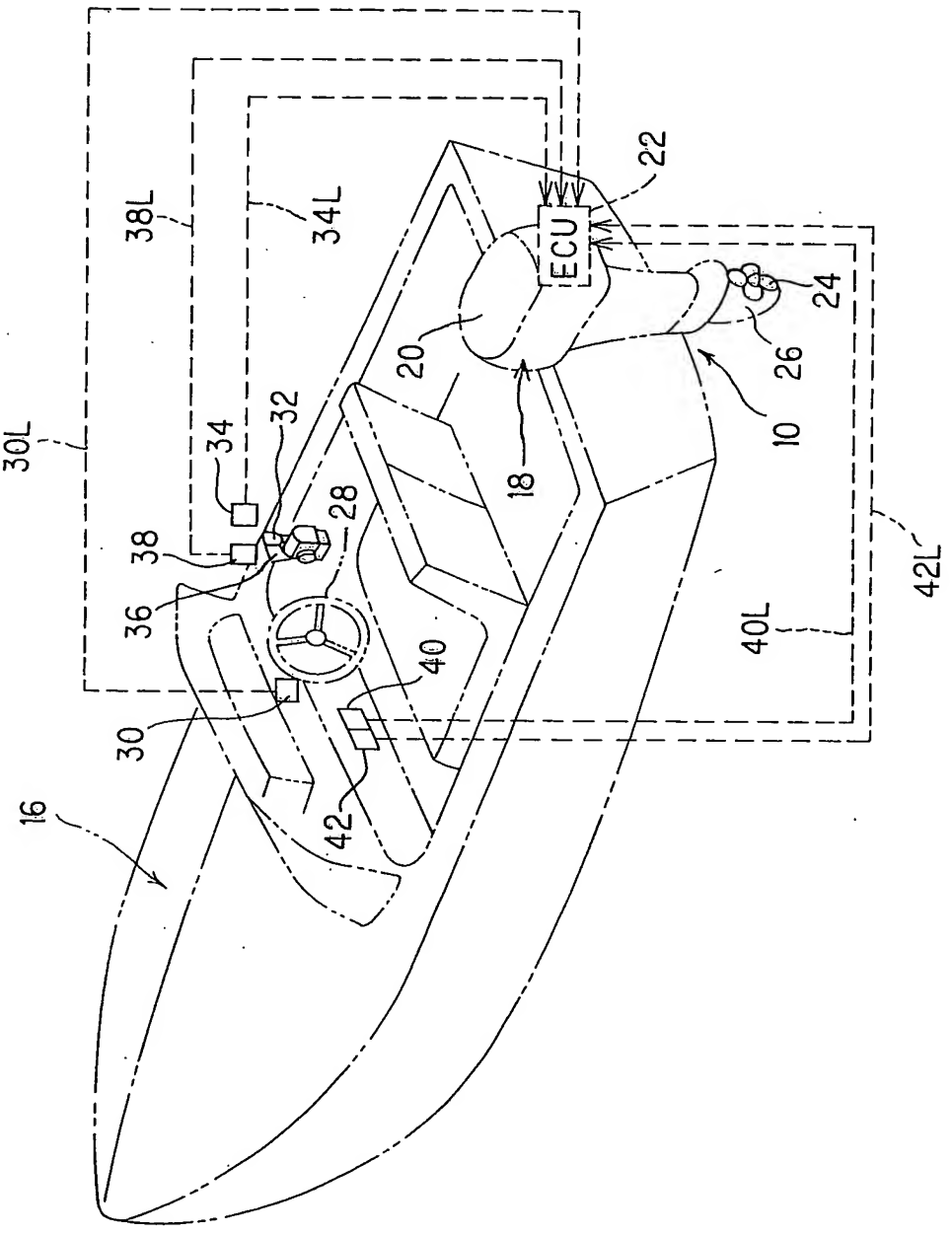

FIG. 2

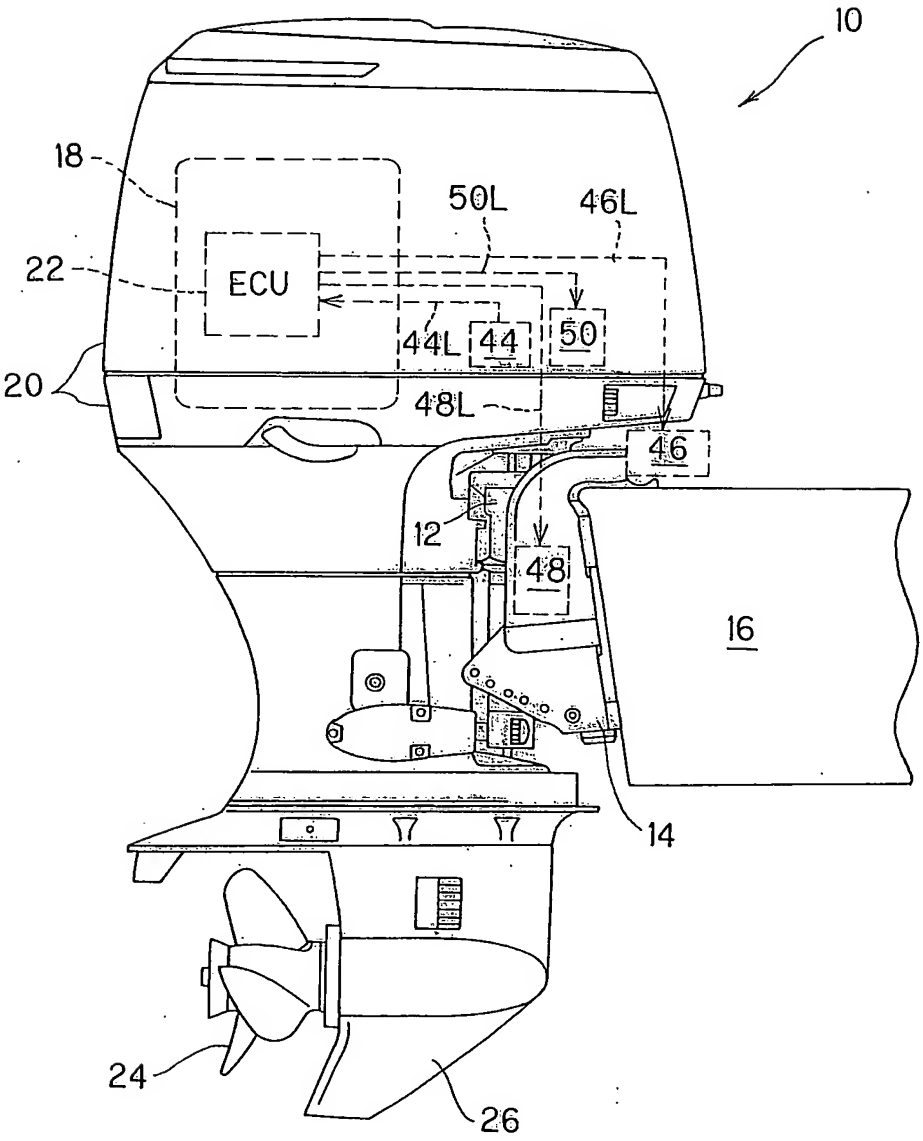

FIG. 3

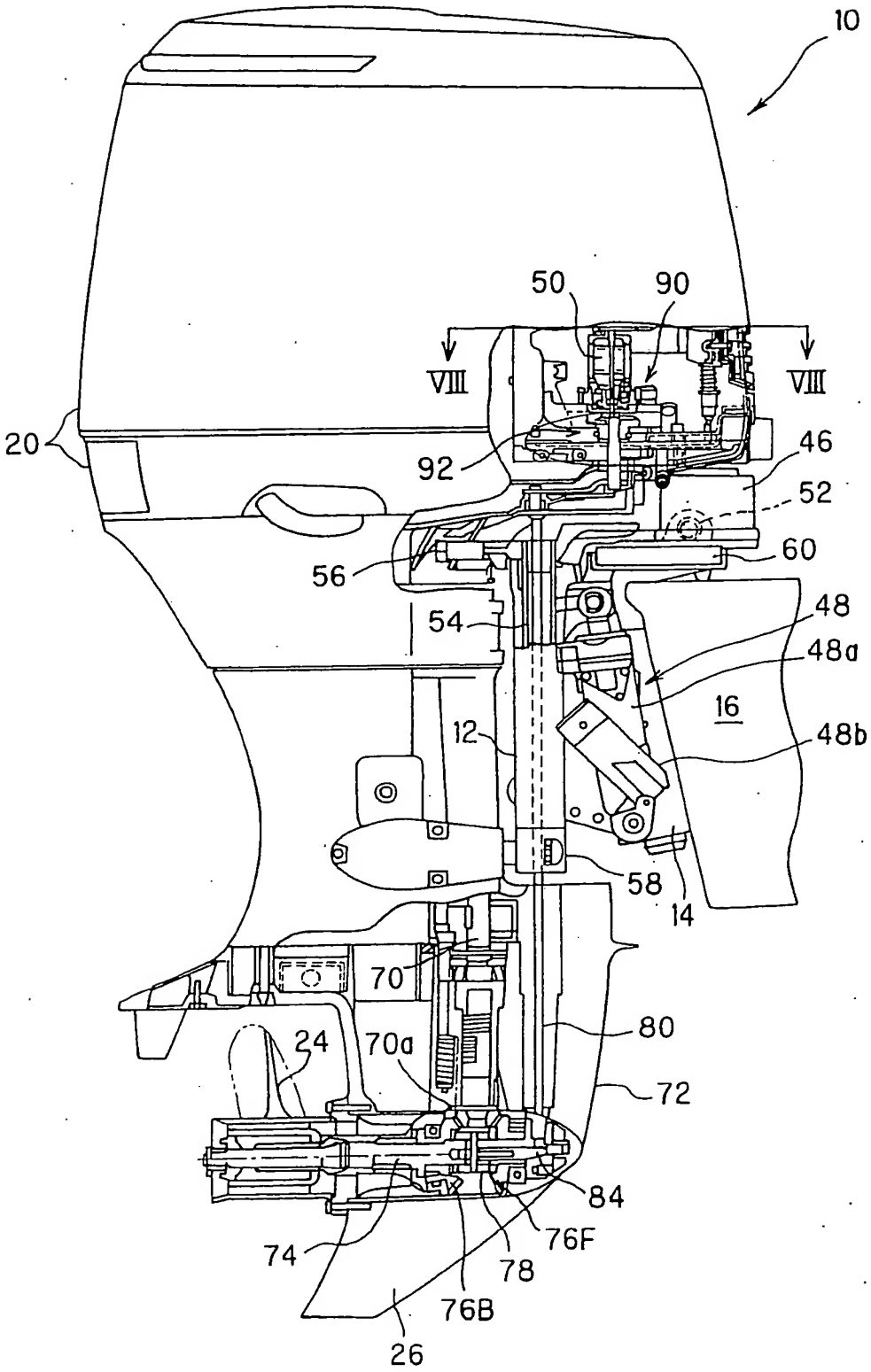
10
50
90
VIII
VIII
20
92
46
52
60
56
54
48
48a
16
12
48b
58
14
70
80
24
70a
72
84
74
76F
78
76B
26

FIG. 4

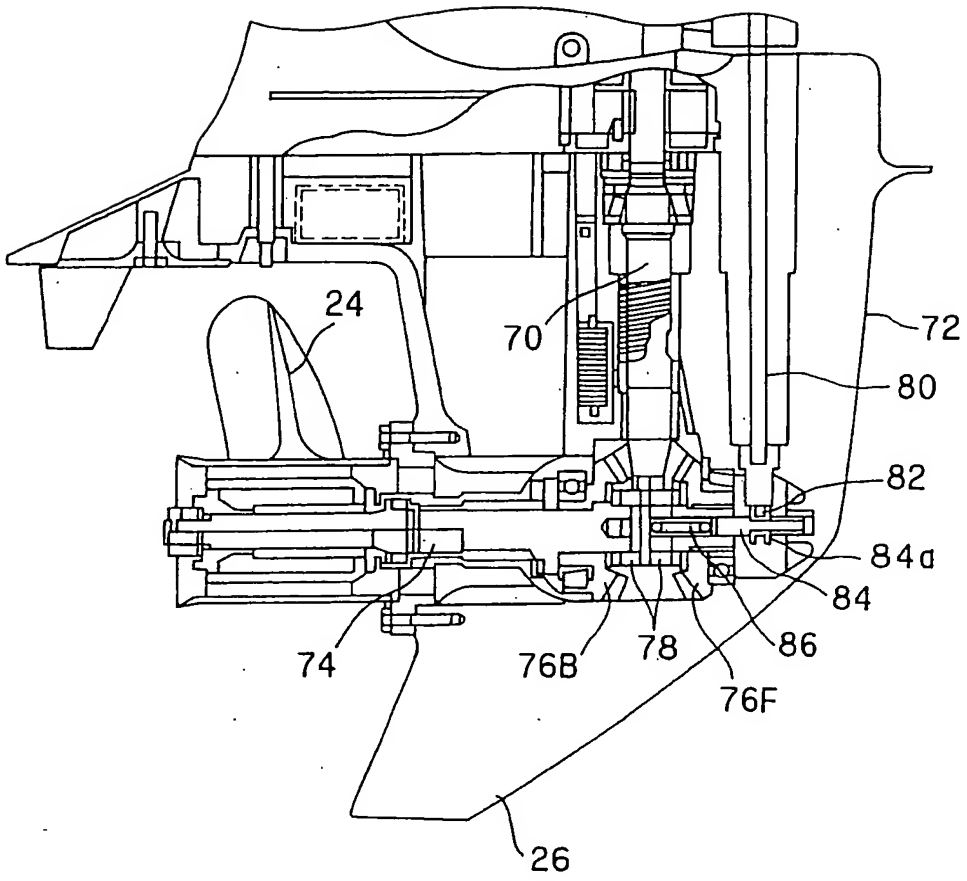

FIG. 5

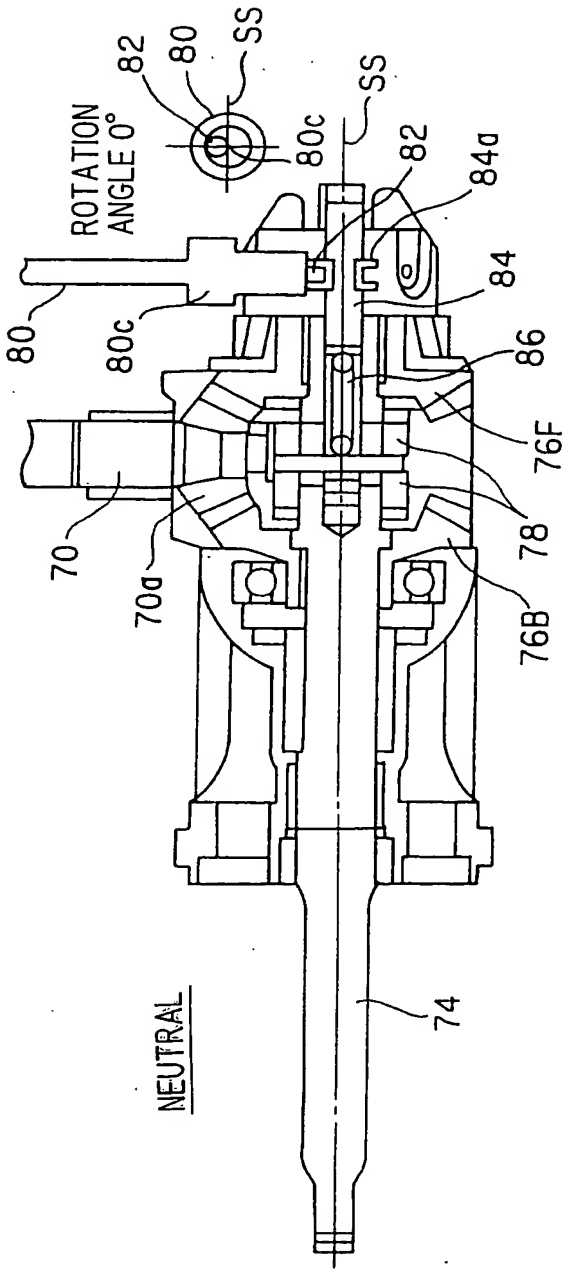
82
80
SS
SS
ROTATION
ANGLE 0°
80c
82
84a
84
80
80c
86
76F
70
70a
78
76B
NEUTRAL
74

FIG. 6

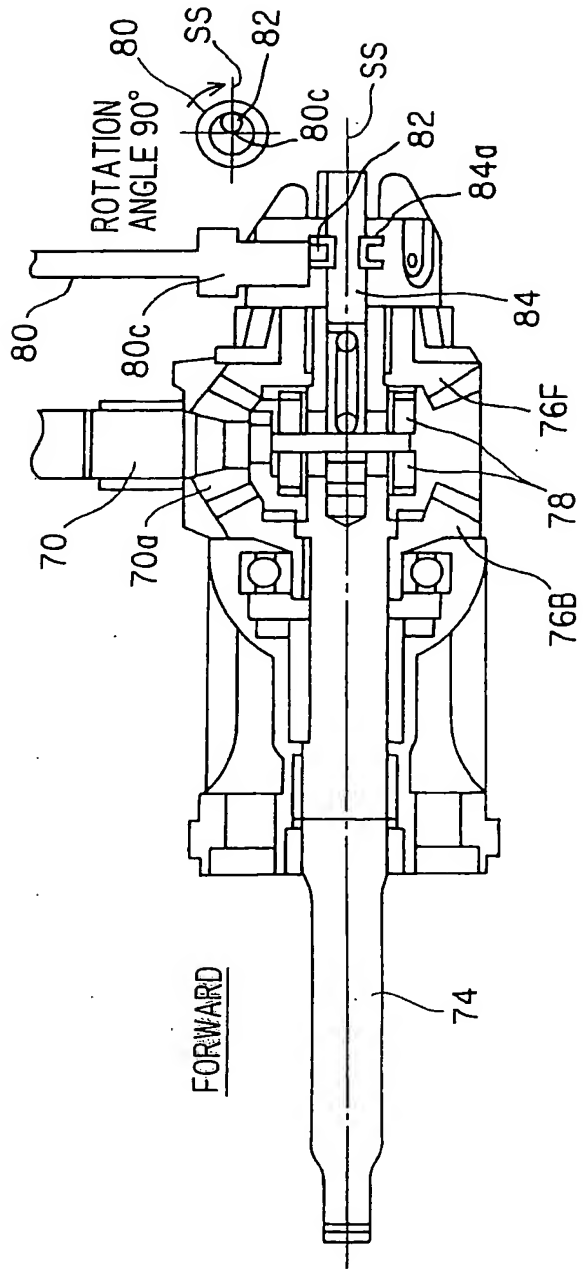
80
SS
82
ROTATION
ANGLE 90°
80c
SS
82
84a
84
80
80c
76F
78
70
70a
76B
74
FORWARD

FIG. 7

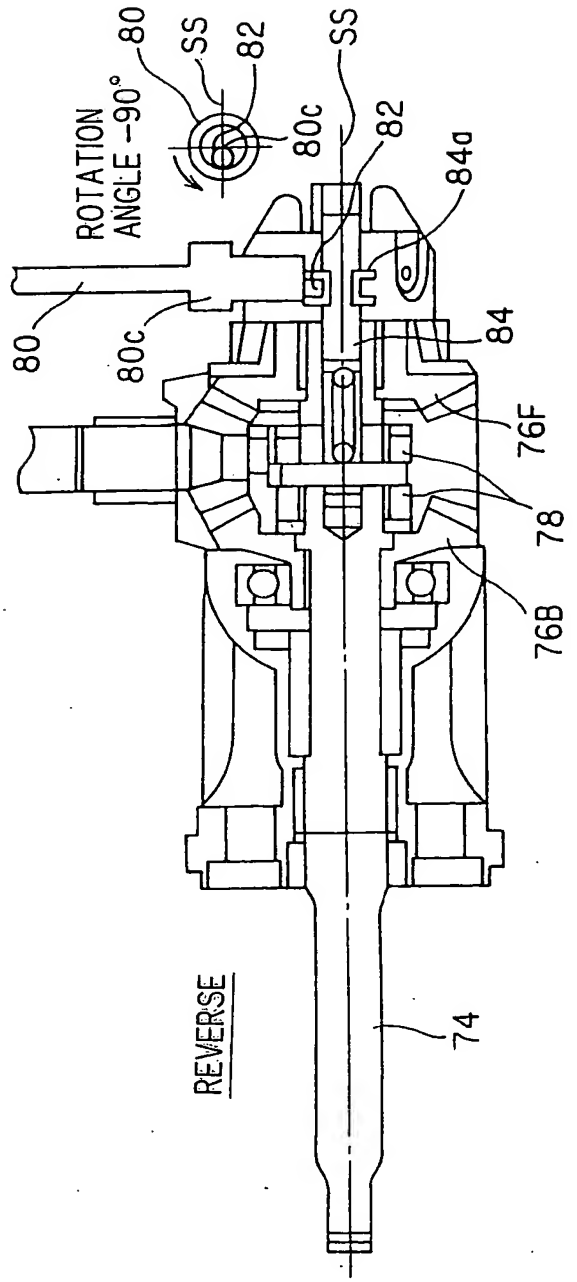
80
SS
82
SS
ROTATION
ANGLE -90°
80c
82
84a
80
80c
84
76F
78
76B
REVERSE
74

FIG. 8

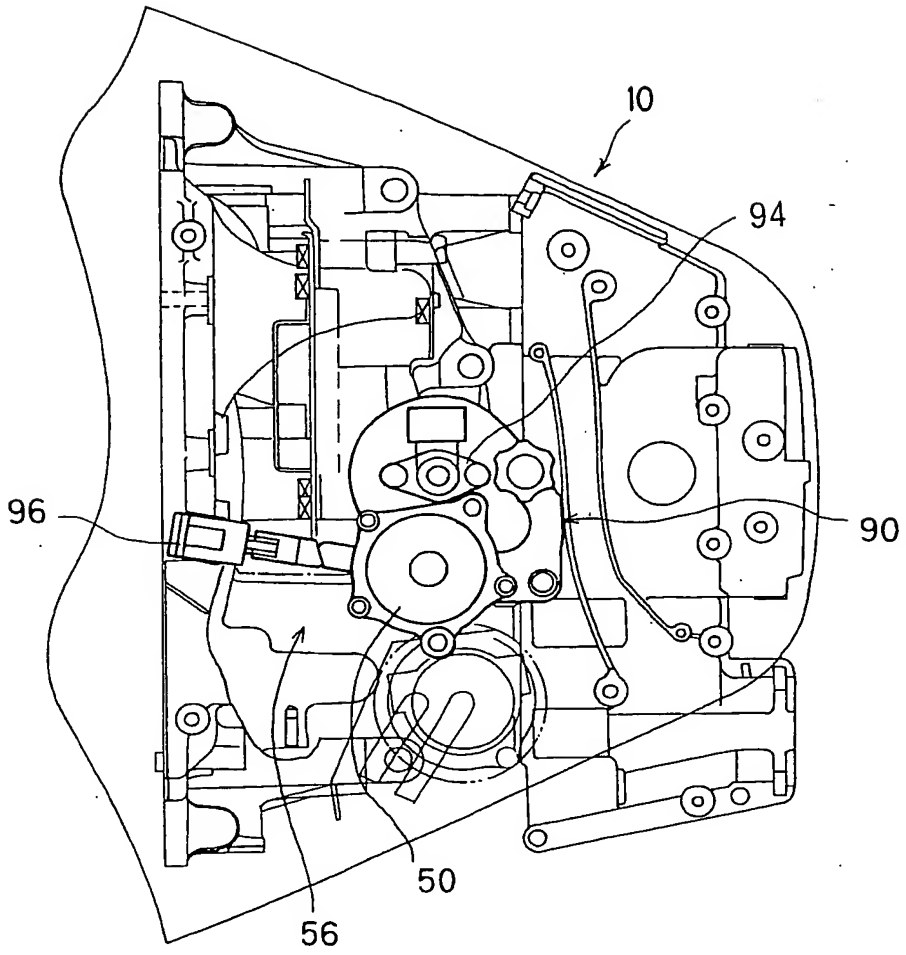

FIG. 9

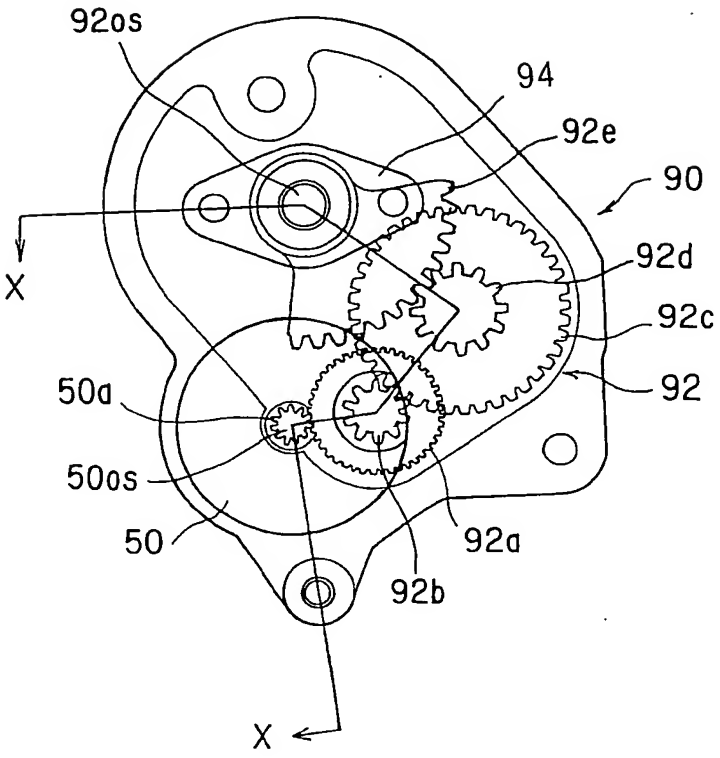

FIG. 10